Name: ____________________ Date: ____________

Polynomial Operations SOLUTION (version 144)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -8x^5 - x^4 + 3x^3 - 7x - 9$$

$$q(x) = -5x^5 - 7x^4 - 3x^3 + 10x^2 - 9$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-8)x^5 + (-1)x^4 + (3)x^3 + (0)x^2 + (-7)x^1 + (-9)x^0 \\ q(x) &= (-5)x^5 + (-7)x^4 + (-3)x^3 + (10)x^2 + (0)x^1 + (-9)x^0 \\ p(x) - q(x) &= (-3)x^5 + (6)x^4 + (6)x^3 + (-10)x^2 + (-7)x^1 + (0)x^0 \\ p(x) - q(x) &= -3x^5 + 6x^4 + 6x^3 - 10x^2 - 7x \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 2x^2 - 6x - 5$$

$$b(x) = -6x + 3$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$2x^2$	$-6x$	-5
$-6x$	$-12x^3$	$36x^2$	$30x$
3	$6x^2$	$-18x$	-15

$$a(x) \cdot b(x) = -12x^3 + 36x^2 + 6x^2 + 30x - 18x - 15$$

Combine like terms.

$$a(x) \cdot b(x) = -12x^3 + 42x^2 + 12x - 15$$

3. Express $(x+1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

Polynomial Operations SOLUTION (version 144)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -2x^3 + 17x^2 + 11x - 28 \\ g(x) &= x - 9 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-9}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{c|cccc} & -2 & 17 & 11 & -28 \\ 9 & & -18 & -9 & 18 \\ \hline & -2 & -1 & 2 & -10 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = -2x^2 - x + 2 + \frac{-10}{x-9}$$

In other words, $h(x) = -2x^2 - x + 2$ and the remainder is $R = -10$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -2x^3 + 17x^2 + 11x - 28$. Evaluate $f(9)$.

You could do this the hard way.

$$\begin{aligned} f(9) &= (-2)\cdot(9)^3 + (17)\cdot(9)^2 + (11)\cdot(9) + (-28) \\ &= (-2)\cdot(729) + (17)\cdot(81) + (11)\cdot(9) + (-28) \\ &= (-1458) + (1377) + (99) + (-28) \\ &= -10 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(9)$ equals the remainder when $f(x)$ is divided by $x - 9$. Thus, $f(9) = -10$.